



Government of the people's Republic of Bangladesh
Ministry of Housing and Public Works
Urban Development Directorate
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PREPARATION OF DEVELOPMENT PLAN FOR MEHERPUR ZILLA

REPORT ON ASSIGNMENT-4

Spatial transformation of Socio-economic Data and Outputs with report.

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Summary of Assignment-4

A. Summary of Assignment-4

This report summarizes Assignment-4 according to the ToR by the Junior GIS Consultant (Individual Consultant) for the “Preparation of Development Plan for Meherpur Zilla "project. The assignment has done by me is “Spatial transformation of Socio-economic Data and Outputs with report”. The detailed process is also summarized in the Report. The report presents an integrated analysis of trip generation and agricultural drought in Meherpur Zila. Based on the socio-economic and transportation survey, the findings show that most trips are generated and attracted within the same union, with Meherpur, Gangni, and Bamandi functioning as the main trip attractors and regional mobility hubs. Unions like Dhankhola, Baradi, and Bagoan exhibit high internal trip activity, while Raypur and Sholotaka demonstrate stronger inter-union linkages, indicating a core–periphery travel structure within the district. The agricultural drought assessment, conducted using Landsat 8 data and indices such as NDVI, LST, and VHI, reveals that moderate to severe drought conditions affect the area across all three agricultural seasons—Kharif-1, Kharif-2, and Rabi. These findings highlight Meherpur Zila’s dual challenges of transport dependency and climatic stress, emphasizing the need for improved connectivity, sustainable water management, and adoption of drought-resilient agricultural practices to enhance regional resilience and productivity.

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Spatial Transformation of Socio-economic Data and Outputs with Report.

Trip Generation Analysis Report for Meherpur Zila

1. Introduction

This report presents the findings from the socio-economic and transportation survey conducted across all unions of Meherpur Zila. The analysis focuses on trip generation and attraction patterns within and between unions to understand mobility dynamics and inter-union connectivity. Each Traffic Analysis Zone (TAZ) represents a union where trip generation and attraction rates have been calculated based on household and transport survey data.

2. Overall Trip Generation Pattern

The survey reveals a strong pattern of intra-union dominance, where most trips are generated and attracted within the same union. In most TAZs, over 70% of total trips remain internal, reflecting localized movement patterns driven by daily needs such as education, markets, employment, and social activities.

Unions like Dhankhola (90.63%), Baradi (90.7%), Meherpur (88.19%), and Bagoan (86.52%) exhibit the highest proportion of internal trips, indicating relatively self-contained mobility systems with limited outward movement. Conversely, unions such as Raypur (35.09%) and Sholotaka (39.51%) show greater inter-union connectivity, reflecting their role as transit corridors or their dependence on neighboring unions for services and employment.

3. Inter-Union Connectivity and Attraction

The interrelation analysis identifies several key patterns of connectivity:

- Meherpur Sadar Union functions as a major trip attractor, drawing notable proportions of trips from adjacent unions such as Buripota, Amdah, Amjhupi, and Kutubpur.
- Gangni and Bamandi also act as secondary attractors, receiving trips from nearby unions including Sholotaka, Raypur, Matmura, and Dhankhola.
- Peripheral unions like Kazipur, Dhankhola, and Bagoan show limited outward attraction, suggesting localized activities and weaker transport linkages.
- Unions such as Tentulbaria and Matmura demonstrate moderate interdependence with neighboring zones, particularly Bamandi and Gangni, indicating functional linkages in trade and transport.

Overall, Meherpur, Gangni, and Bamandi emerge as the primary nodes in the district's trip generation network, forming the core of regional mobility.

4. Spatial Mobility Characteristics

Spatially, trip generation intensity follows a core–periphery gradient:

- Central unions (Meherpur, Gangni, Bamandi, Kutubpur) show higher trip interactions due to dense population, service availability, and administrative importance.
- Peripheral unions (Bagoan, Dariapur, Monakhali, and Raypur) exhibit localized movements with relatively lower external trip dependency.
- Intermediate unions (Matmura, Tentulbaria, Kazipur, and Sholotaka) act as transitional zones, linking rural hinterlands with urban centers.

This pattern suggests that trip attraction correlates strongly with access to urban functions, educational institutions, healthcare, and commercial activities concentrated in Meherpur Sadar.

5. Comparative Summary of Key Indicators

Union (TAZ)	Highest Internal Trip %	Major External Attraction	Remarks
Dhankhola	90.63%	Gangni, Meherpur	Strongly self-contained
Baradi	90.7%	Amjhupi	Localized trips
Meherpur	88.19%	Buripota, Kutubpur	District mobility hub
Bagoan	86.52%	Monakhali	Peripheral but active
Gangni	84.27%	Meherpur	Secondary urban center
Bamandi	83.34%	Kazipur, Matmura	High internal linkage
Kutubpur	75.19%	Meherpur	Urban fringe linkage
Raypur	35.09%	Gangni, Meherpur	Highly interconnected

6. Key Observations

1. Self-sufficiency: Most unions maintain high internal trip generation, highlighting self-sufficient socio-economic systems.
2. Centralization: Meherpur Sadar acts as the dominant transport and service hub.

3. Secondary Centers: Gangni and Bamandi serve as important regional connectors facilitating inter-union trips.
4. Peripheral Dependence: Peripheral unions rely on central unions for access to education, healthcare, and markets.
5. Mobility Corridor: The Meherpur–Gangni–Bamandi axis forms the primary mobility corridor within the district.

7. Conclusion

The trip generation and attraction analysis for Meherpur Zila reveals a predominantly intra-union movement pattern, with significant inter-union connectivity centered around Meherpur, Gangni, and Bamandi. The findings highlight spatial variations in accessibility, service distribution, and socio-economic interaction among unions. These insights are crucial for transportation planning, identifying potential areas for infrastructure improvement, and promoting balanced regional development within Meherpur Zila.

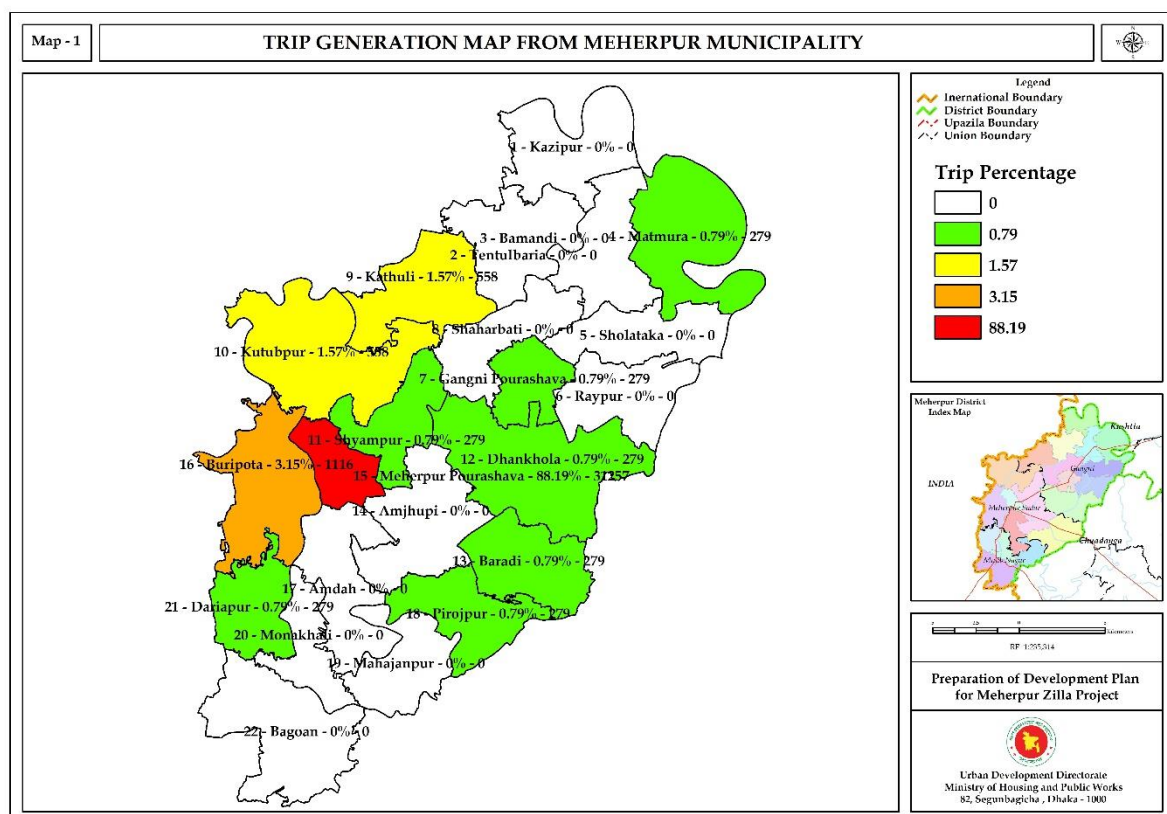
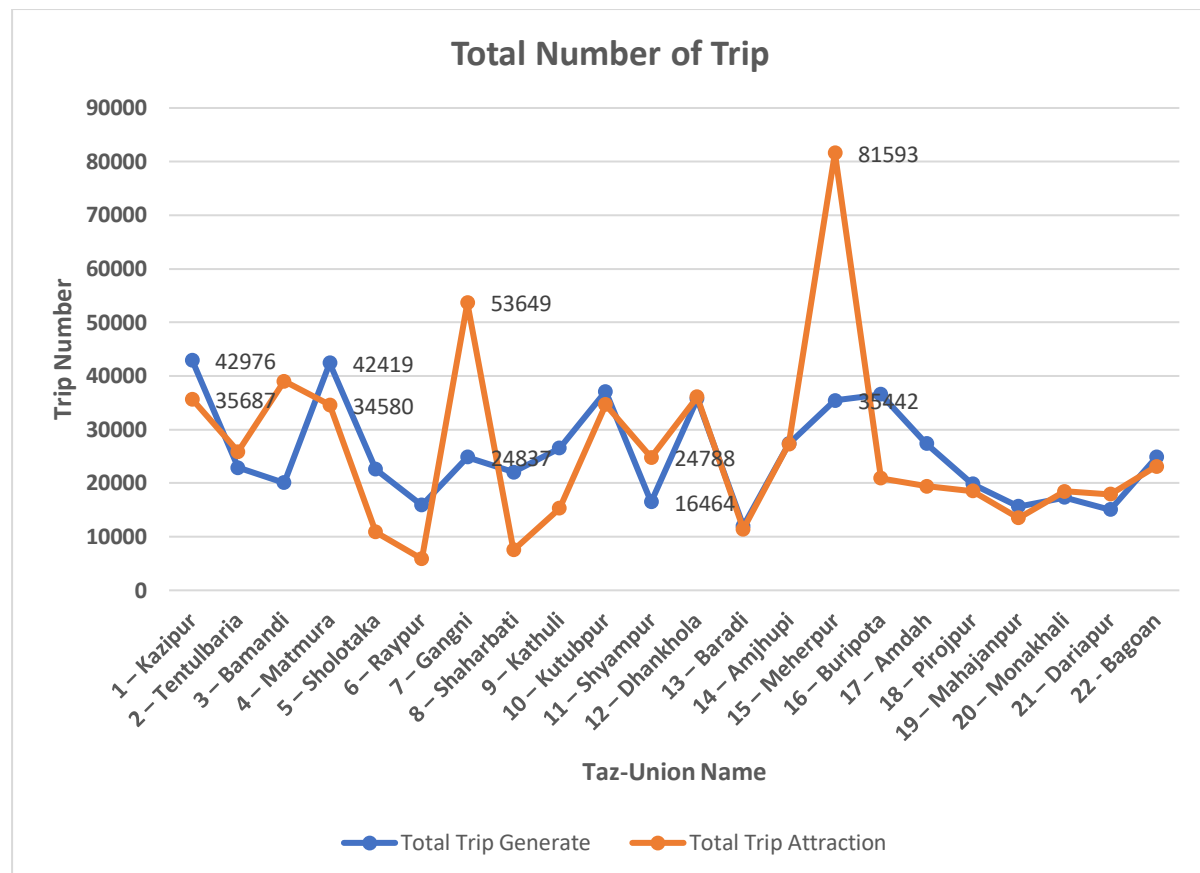


Figure: Trip Generation Map from Meherpur Municipality

Purpose of Trip Generation and Attarction:

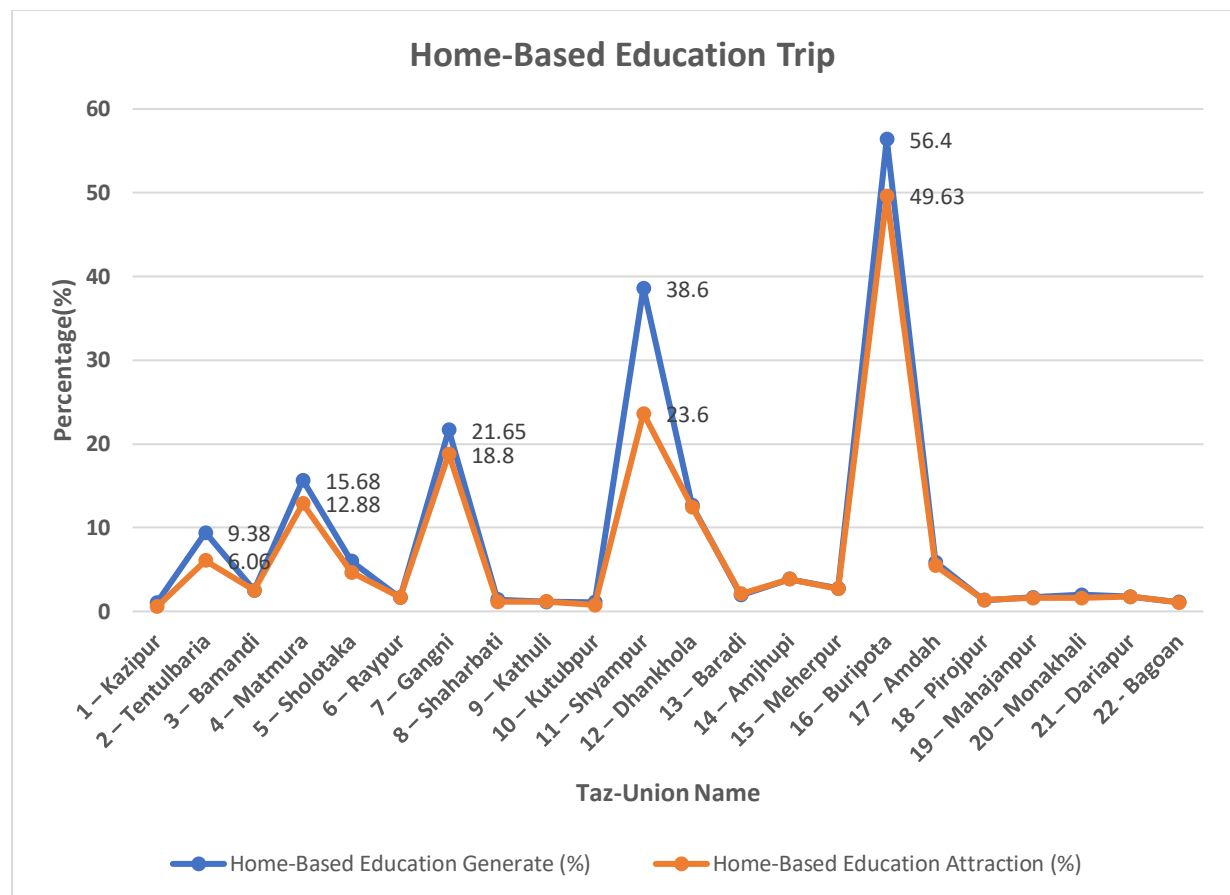
Total Trip Generated:



The line chart titled "**Total Number of Trips**" provides a visual comparison of trip generation and attraction across 22 Taz-Unions. The blue line, representing **Total Trip Generated**, shows a relatively stable pattern, generally fluctuating between 20,000 and 40,000 trips. In contrast, the orange line, for **Total Trip Attraction**, is far more volatile, with the number of trips varying significantly between locations.

The data reveals that some Taz-Unions are major trip attractors, most notably "**15 – Meherpur**" which recorded the highest peak at **81,593 trips**, and "**7 – Gangni**" at **53,649 trips**. These two unions show a clear imbalance where the number of trips attracted far exceeds those generated. Other unions, such as "**1 – Kazipur**" (42,976 generate vs. 35,687 attract) and "**3 – Bamandi**" (21,570 generate vs. 39,475 attract), demonstrate a closer, though not always equal, relationship between trips generated and attracted. The chart effectively illustrates the differing roles of these unions in the regional travel network, with some acting as key destinations while others serve primarily as residential or originating points.

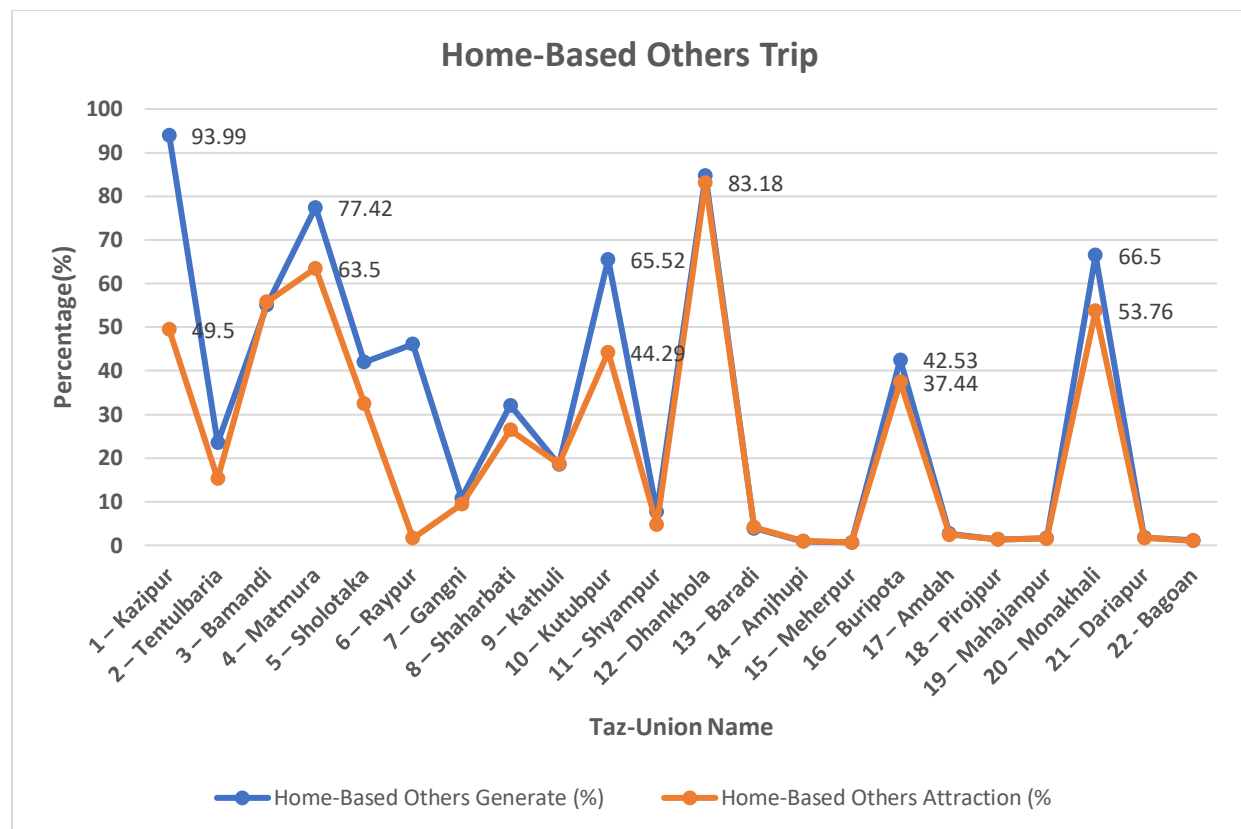
Home-Based Education:



The line chart titled "**Home-Based Education Trip**" provides a detailed comparison of the percentage of trips generated and attracted for educational purposes across 22 Taz-Unions. The percentages for both trip generation (blue line) and trip attraction (orange line) generally follow a similar trend, rising and falling in unison across the different unions.

The data reveals that one location, "**16 – Buripota,**" is a significant hub for this specific trip type, accounting for **56.4%** of all generated trips and **49.63%** of all attracted trips. Other locations, such as "**11 – Shyampur**" (38.6% of generated trips) and "**7 – Gangni**" (21.65%), also show notable activity. The chart also highlights unions with very low or negligible percentages for both generation and attraction, such as "**8 – Shaharbari**" (0.24% generated, 0.44% attracted) and "**9 – Kathuli**" (0.24% generated, 0.16% attracted), indicating that home-based education travel is highly concentrated in specific areas.

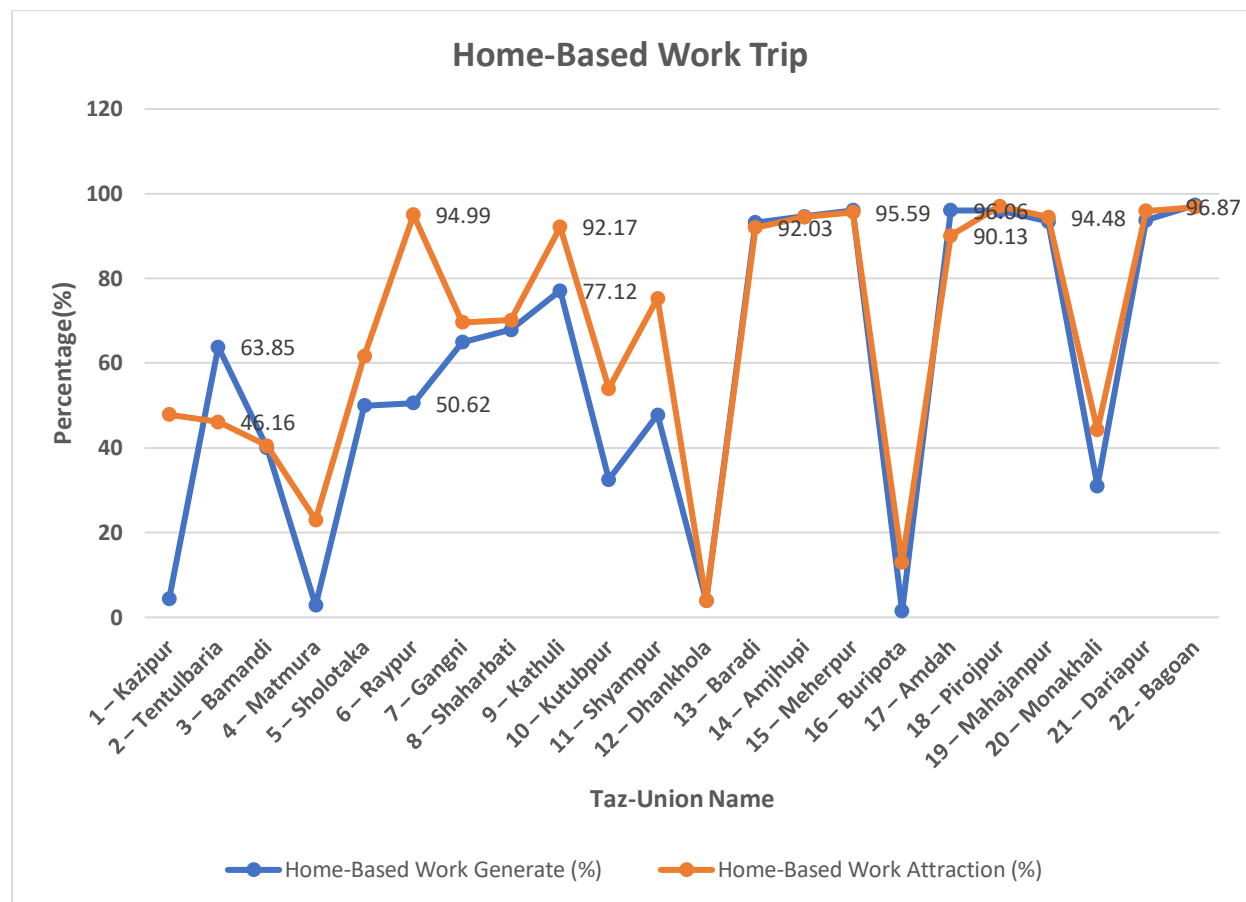
Home-Based Others:



The line graph, titled "**Home-Based Others Trip**," illustrates the percentage of trips generated and attracted for non-education and non-work purposes across 22 Taz-Unions. The percentages for these trip types show a high degree of variation, with several distinct peaks.

The chart reveals that "**1 – Kazipur**" is a major generator of these trips at **93.99%**, although its attraction percentage is much lower at **49.5%**. Another notable peak is at "**12 – Dhankhola**," where both generation and attraction percentages are nearly identical and very high, at **83.18%** each, suggesting a balanced hub for this trip type. Other high points include "**4 – Matmura**" and "**20 – Monakhali**," both of which show significantly more generated trips than attracted. Conversely, locations like "**15 – Meherpur**" and "**17 – Amdah**" show extremely low percentages for both trip generation and attraction, indicating minimal activity for "other" purposes. The graph highlights the highly localized and uneven distribution of these specific types of trips.

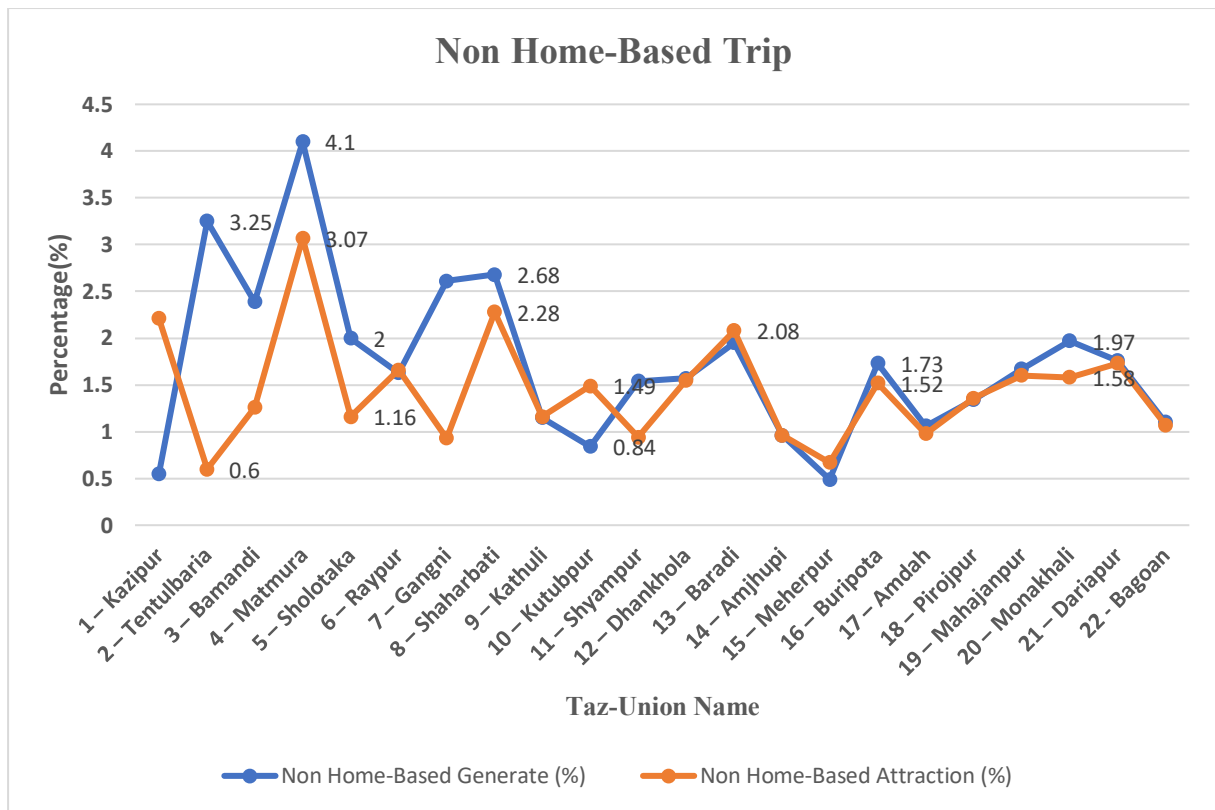
Home-Based Work:



The line chart titled "**Home-Based Work Trip**" provides a detailed comparison of the percentage of trips generated and attracted for Work purposes across 22 Taz-Unions. The percentages for both trip generation (blue line) and trip attraction (orange line) generally follow a similar trend, rising and falling in unison across the different unions.

Based on the chart, the lowest percentages of home-based work-generated trips were found in **Matmura** and **Dhankhola** at approximately **0%** each, followed by **Tentulbaria** at **63.85%**. In contrast, the highest generation percentages were in **Amhdah** at **96.06%**, and in **Bagoan** at **96.87%**. For home-based work attraction, the lowest percentages were in **Matmura** at **23.36%**, **Buripota** at **0%**, and **Tentulbaria** at **46.16%**. The highest attraction percentages were in **Raypur** at **94.99%**, **Kathuli** at **92.17%**, **Baradi** at **92.03%**, **Pirojpur** at **90.13%**, **Dariaapur** at **94.48%**, **Meherpur** at **95.59%**, and **Bagoan** at **96.87%**.

Non-Home-Based:



The line chart titled "**Home-Based Work Trip**" provides a detailed comparison of the percentage of trips generated and attracted for Work purposes across 22 Taz-Unions. The percentages for both trip generation (blue line) and trip attraction (orange line) generally follow a similar trend, rising and falling in unison across the different unions.

Based on the provided data, the lowest percentages for **non-home-based trip generation** were found in **Tentulbaria** at **0.6%**. In contrast, the highest generation percentages were in **Matmura** at **4.1%** and **Shaharbari** at **2.68%**, with **Monakhali** also showing a notable percentage of **1.97%**. Regarding **non-home-based trip attraction**, the lowest percentages were observed in **Tentulbaria** at **0.6%** and **Kutubpur** at **0.84%**. The highest attraction percentages were in **Matmura** at **3.07%**, **Sholotaka** at **1.16%**, and **Shaharbari** at **2.28%**, while **Baradi** also had high attraction rates at **2.08%** respectively.

Agricultural Drought analysis of Meherpur Zila

Meherpur Zila, located in the south-western region of Bangladesh, is predominantly an agricultural district where crop cultivation depends heavily on seasonal rainfall and groundwater resources. Agricultural drought has become a recurrent challenge in the area, caused by irregular rainfall, rising temperatures, and depletion of soil moisture during critical growing seasons. These drought conditions reduce crop yields, threaten food security, and affect the livelihoods of a large portion of the population who rely on agriculture as their primary income source. Understanding the extent and impact of agricultural drought in Meherpur is essential for developing sustainable water management practices, adaptive farming techniques, and policy measures to ensure resilience against future climatic stress.

Agricultural drought in Meherpur Zila has been evaluated using remote sensing and geospatial techniques to capture the spatial and seasonal variations of drought severity. For this purpose, **Landsat 8 satellite imagery** was utilized, which was obtained from the **United States Geological Survey (USGS)**. The analysis focused on two key indicators: the **Land Surface Temperature (LST)** and the **Normalized Difference Vegetation Index (NDVI)**, both of which are widely used in drought assessment.

The study considered three agricultural seasons that reflect the cropping calendar of the district:

- **Pre-Monsoon (March–July):** representing the *Kharif-1* cropping period, when early seasonal crops are grown.
- **Monsoon (August–November):** representing the *Kharif-2* cropping period, dominated by paddy cultivation and high rainfall dependency.
- **Winter/Dry Season (December–February):** representing the *Rabi* cropping period, when wheat, pulses, and other dry season crops are cultivated.

From NDVI, the **Vegetation Condition Index (VCI)** was calculated, which indicates the relative greenness and vigor of vegetation compared to its historical range. On the other hand, LST was used to derive the **Temperature Condition Index (TCI)**, which reflects the level of heat stress experienced by crops. To provide a comprehensive drought assessment, these two indices were integrated into the **Vegetation Health Index (VHI)**, a composite indicator that combines vegetation and temperature conditions to evaluate agricultural stress levels more accurately.

Based on the VHI values, agricultural drought was categorized into **five classes**:

1. **No Drought** – indicating healthy vegetation and favorable temperature conditions.
2. **Mild Drought** – showing early signs of water stress.
3. **Moderate Drought** – reflecting reduced vegetation vigor and moderate heat stress.
4. **Severe Drought** – highlighting significant vegetation decline and high temperature stress.
5. **Extreme Drought** – representing critical crop stress conditions with minimal vegetation activity.

This methodology provides a clear framework for monitoring agricultural drought in Meherpur Zila across different cropping seasons. It not only highlights the spatial extent and intensity of drought but also supports better planning for crop management, irrigation strategies, and drought mitigation policies.

Pre-Monsoon Season:

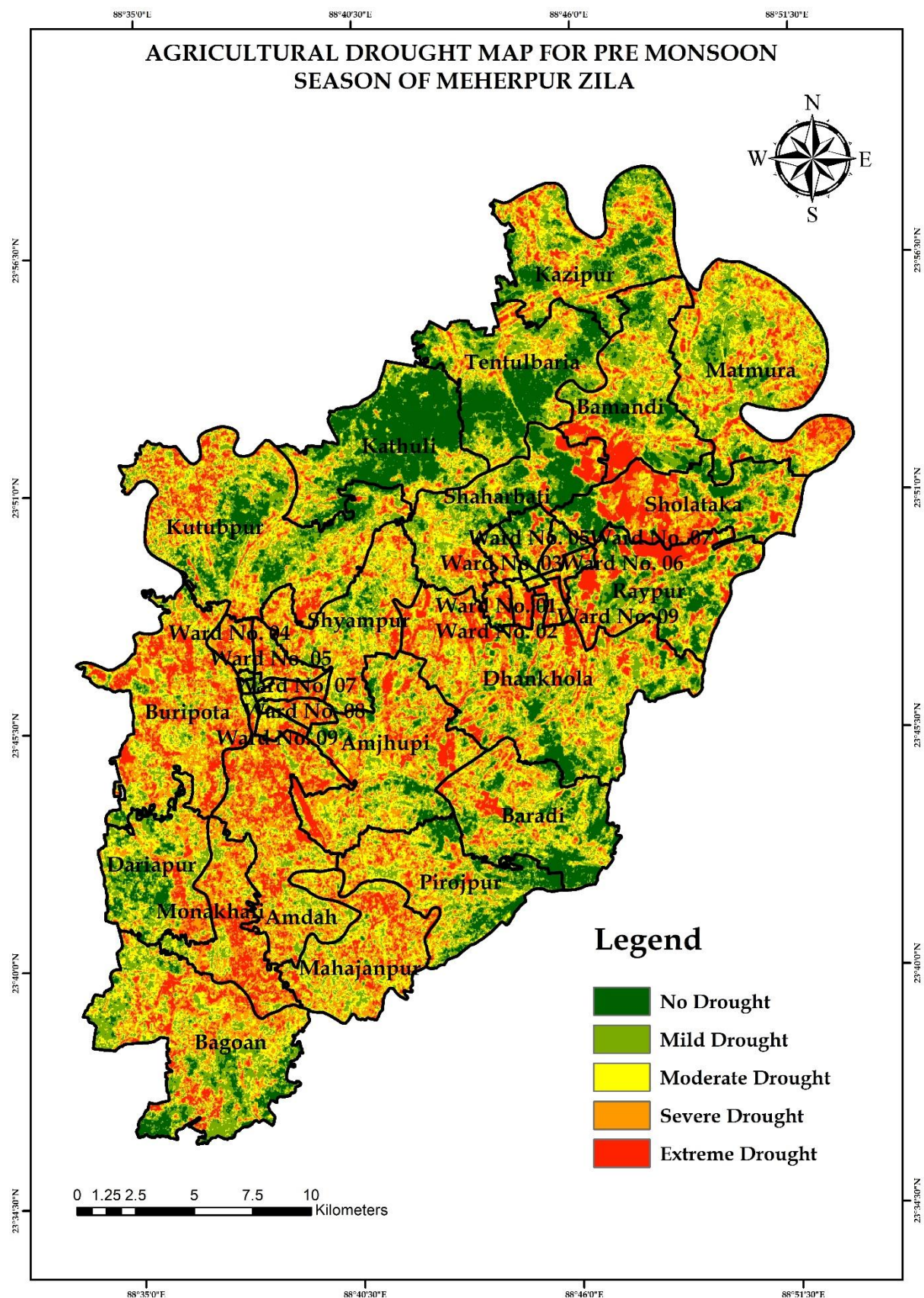


Figure 1: Agricultural Drought Map for Pre-Monsoon Season of Meherpur Zila

Figure 1 represents the agricultural drought map for the pre-monsoon season (March–July), which corresponds to the *Kharif-1* cropping period in Meherpur Zila. The analysis was conducted using **Landsat 8 satellite imagery** of **May 2024**, a representative month when pre-monsoon drought conditions typically reach their peak due to high temperature, low rainfall, and excessive evapotranspiration.

The classification of drought severity was divided into five categories—No Drought, Mild Drought, Moderate Drought, Severe Drought, and Extreme Drought—based on the Vegetation Health Index (VHI). The spatial distribution and statistical summary of the results are as follows:

- **No Drought:** 91.99 sq. km (**12.81%**)
- **Mild Drought:** 160.06 sq. km (**22.29%**)
- **Moderate Drought:** 192.90 sq. km (**26.86%**)
- **Severe Drought:** 179.37 sq. km (**24.97%**)
- **Extreme Drought:** 93.94 sq. km (**13.08%**)

The results clearly show that the **moderate drought category dominates the district**, affecting the largest proportion of land (192.90 sq. km, 26.86%). This is closely followed by **severe drought conditions** (179.37 sq. km, 24.97%), which together account for more than **half of the total study area**. The presence of **extreme drought** in 93.94 sq. km (13.08%) further highlights the vulnerability of agricultural land during this season. In contrast, only a small portion of the district (91.99 sq. km, 12.81%) was free from drought stress, indicating that the majority of agricultural land was under varying levels of water and heat stress.

Overall, the analysis reveals that during the pre-monsoon season of 2024, Meherpur Zila experienced **widespread agricultural drought**, with nearly **65% of the area falling under moderate to severe drought conditions**. Such conditions can significantly reduce the growth and yield of *Kharif-1* crops, especially those highly dependent on soil moisture during the early stages of development. This emphasizes the need for **improved irrigation facilities, efficient water resource management, and the adoption of drought-resilient crop varieties** to mitigate the adverse impacts of pre-monsoon drought in the region.

Monsoon Season:

Figure 2 represents the agricultural drought map for the monsoon season (August–November), which corresponds to the *Kharif-2* cropping period in Meherpur Zila. The assessment was conducted using **Landsat 8 satellite imagery** of **November 2024**, representing the post-monsoon period when the effects of drought on *Kharif-2* crops can be clearly observed.

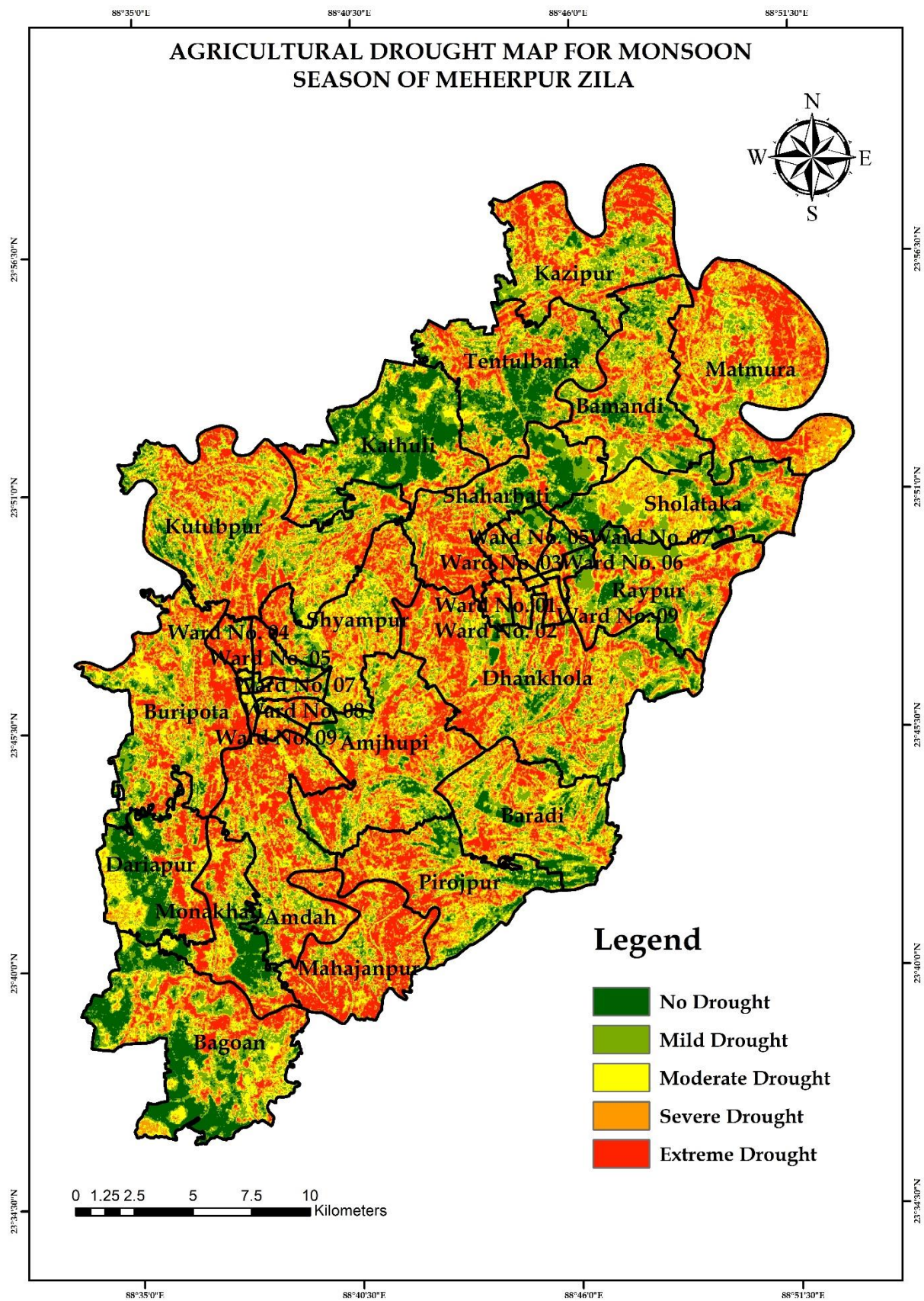


Figure 2: Agricultural Drought Map for Monsoon Season of Meherpur Zila

The drought severity was classified into five categories—No Drought, Mild Drought, Moderate Drought, Severe Drought, and Extreme Drought—based on the Vegetation Health Index (VHI). The spatial extent of each category is summarized below:

- **No Drought:** 74.90 sq. km (**10.43%**)
- **Mild Drought:** 134.18 sq. km (**18.68%**)
- **Moderate Drought:** 177.88 sq. km (**24.77%**)
- **Severe Drought:** 187.34 sq. km (**26.08%**)
- **Extreme Drought:** 143.97 sq. km (**20.04%**)

The results reveal that **severe drought conditions dominate the district**, affecting the largest share of land (187.34 sq. km, 26.08%). This is closely followed by **moderate drought** (177.88 sq. km, 24.77%) and **extreme drought** (143.97 sq. km, 20.04%). Together, these categories account for more than **70% of the total study area**, indicating widespread agricultural stress during the monsoon cropping period. In contrast, only **10.43% of the land (74.90 sq. km)** was unaffected by drought, while **18.68% (134.18 sq. km)** experienced mild drought.

Overall, the findings highlight that during the **monsoon season of 2024**, agricultural drought in Meherpur Zila was more widespread and severe compared to the pre-monsoon period. The dominance of severe and extreme drought categories suggests that despite seasonal rainfall, many areas suffered from **water stress, uneven rainfall distribution, or soil moisture deficits**. Such conditions pose significant risks to *Kharif-2* crops, particularly paddy, which is highly water-dependent. The results emphasize the necessity of **enhanced water management strategies, rainwater harvesting, and adaptive agricultural practices** to safeguard crop production during the monsoon season.

Dry/ Winter Season:

Figure 3 represents the agricultural drought map for the winter/dry season (December–February), corresponding to the *Rabi* cropping period in Meherpur Zila. For this analysis, **Landsat 8 satellite imagery of February 2024** was utilized, representing the late winter period when water stress can significantly affect *Rabi* crops.

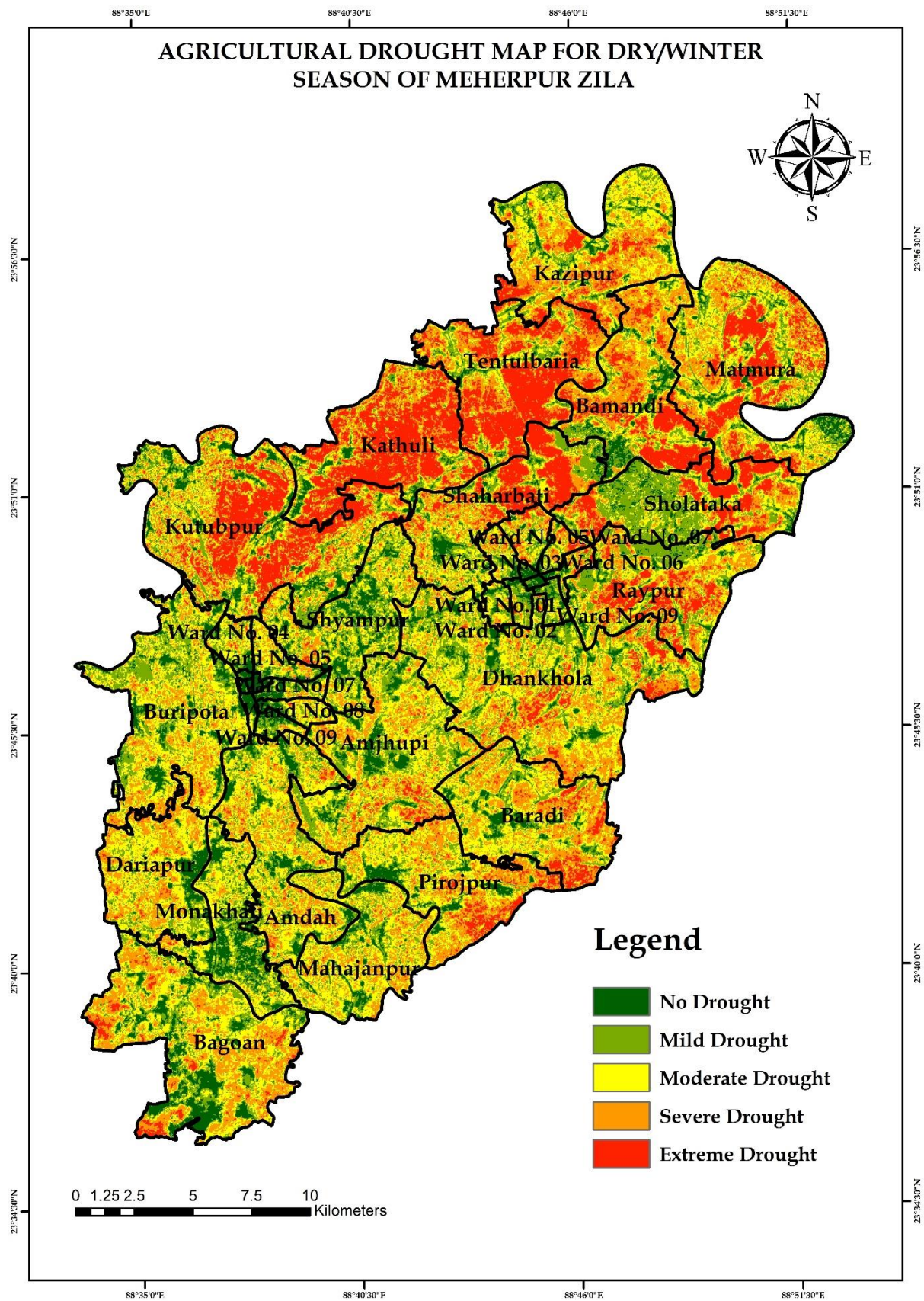


Figure 3: Agricultural Drought Map for Dry/ Winter Season of Meherpur Zila

Drought severity was classified into five categories—No Drought, Mild Drought, Moderate Drought, Severe Drought, and Extreme Drought—using the **Vegetation Health Index (VHI)** derived from the combination of **Normalized Difference Vegetation Index (NDVI)** and **Land Surface Temperature (LST)**. The spatial extent of each category is summarized below:

- **No Drought:** 62.67 sq. km (**8.73%**)
- **Mild Drought:** 157.35 sq. km (**21.91%**)
- **Moderate Drought:** 211.52 sq. km (**29.46%**)
- **Severe Drought:** 185.89 sq. km (**25.89%**)
- **Extreme Drought:** 100.83 sq. km (**14.04%**)

The analysis indicates that **moderate drought** is the most prevalent category, covering **211.52 sq. km (29.46%)** of the district. This is followed closely by **severe drought** (185.89 sq. km, 25.89%) and **mild drought** (157.35 sq. km, 21.91%). **Extreme drought** affected **100.83 sq. km (14.04%)**, while only a small portion of the area, **62.67 sq. km (8.73%)**, experienced **no drought** conditions.

These results suggest that during the winter/dry season of 2024, a significant portion of Meherpur Zila faced agricultural drought, potentially impacting the growth and yield of Rabi crops such as wheat, pulses, and vegetables. The predominance of moderate to severe drought across more than **55% of the area** highlights the **persistent water stress challenges** in this season. Such findings emphasize the need for **efficient irrigation management, soil moisture conservation practices, and the cultivation of drought-tolerant crop varieties** to mitigate the adverse effects of winter/dry season drought in the region.

The analysis of agricultural drought in Meherpur Zila using **Landsat 8 imagery** reveals that moderate to severe drought affects a significant portion of the district across all seasons. Pre-monsoon, monsoon, and winter/dry seasons show widespread drought stress, impacting *Kharif-1*, *Kharif-2*, and *Rabi* crops, respectively. These findings highlight the need for **effective water management, irrigation improvements, and drought-resilient cropping practices** to ensure sustainable agricultural productivity and resilience against seasonal droughts.